

Chapter 1. The UNIX Operating System

Introduction

This chapter introduces you to the UNIX operating system. We first look at what is an operating system and then proceed to discuss the different features of UNIX that have made it a popular operating system.

Objectives

- What is an operating system (OS)?
- Features of UNIX OS
- A Brief History of UNIX OS, POSIX and Single Unix Specification (SUS)

1. What is an operating system (OS)?

An operating system (OS) is a resource manager. It takes the form of a set of software routines that allow users and application programs to access system resources (e.g. the CPU, memory, disks, modems, printers, network cards etc.) in a **safe**, **efficient** and **abstract** way.

For example, an OS ensures **safe** access to a printer by allowing only one application program to send data directly to the printer at any one time. An OS encourages **efficient** use of the CPU by suspending programs that are waiting for I/O operations to complete to make way for programs that can use the CPU more productively. An OS also provides convenient **abstractions** (such as files rather than disk locations) which isolate application programmers and users from the details of the underlying hardware.

User Applications	
Application Programs	System Utilities
System Call Interface	
Operating System Kernel	
Processor/Hardware	

UNIX Operating system allows complex tasks to be performed with a few keystrokes. It doesn't tell or warn the user about the consequences of the command.

Kernighan and Pike (The UNIX Programming Environment) lamented long ago that “as the UNIX system has spread, the fraction of its users who are skilled in its application has decreased.” However, the capabilities of UNIX are limited only by your imagination.

2. Features of UNIX OS

Several features of UNIX have made it popular. Some of them are:

Portable

UNIX can be installed on many hardware platforms. Its widespread use can be traced to the decision to develop it using the C language.

Multuser

The UNIX design allows multiple users to concurrently share hardware and software

Multitasking

UNIX allows a user to run more than one program at a time. In fact more than one program can be running in the background while a user is working foreground.

Networking

While UNIX was developed to be an interactive, multiuser, multitasking system, networking is also incorporated into the heart of the operating system. Access to another system uses a standard communications protocol known as Transmission Control Protocol/Internet Protocol (TCP/IP).

Organized File System

UNIX has a very organized file and directory system that allows users to organize and maintain files.

Device Independence

UNIX treats input/output devices like ordinary files. The source or destination for file input and output is easily controlled through a UNIX design feature called redirection.

Utilities

UNIX provides a rich library of utilities that can be use to increase user productivity.

3. A Brief History of UNIX

In the late 1960s, researchers from General Electric, MIT and Bell Labs launched a joint project to develop an ambitious multi-user, multi-tasking OS for mainframe computers known as MULTICS (Multiplexed Information and Computing System). MULTICS failed, but it did inspire Ken Thompson, who was a researcher at Bell Labs, to have a go at writing a simpler operating system himself. He wrote a simpler version of MULTICS on a PDP7 in assembler and called his attempt UNICS (Uniplexed Information and Computing System). Because memory and CPU power were at a premium in those days, UNICS (eventually shortened to UNIX) used short commands to minimize the space

needed to store them and the time needed to decode them - hence the tradition of short UNIX commands we use today, e.g. ls, cp, rm, mv etc.

Ken Thompson then teamed up with Dennis Ritchie, the author of the first C compiler in 1973. They rewrote the UNIX kernel in C - this was a big step forwards in terms of the system's portability - and released the Fifth Edition of UNIX to universities in 1974. The Seventh Edition, released in 1978, marked a split in UNIX development into two main branches: SYSV (System 5) and BSD (Berkeley Software Distribution). BSD arose from the University of California at Berkeley where Ken Thompson spent a sabbatical year. Its development was continued by students at Berkeley and other research institutions. SYSV was developed by AT&T and other commercial companies. UNIX flavors based on SYSV have traditionally been more conservative, but better supported than BSD-based flavors.

Until recently, UNIX standards were nearly as numerous as its variants. In early days, AT&T published a document called System V Interface Definition (SVID). X/OPEN (now The Open Group), a consortium of vendors and users, had one too, in the X/Open Portability Guide (XPG). In the US, yet another set of standards, named Portable Operating System Interface for Computer Environments (POSIX), were developed at the behest of the Institution of Electrical and Electronics Engineers (IEEE).

In 1998, X/OPEN and IEEE undertook an ambitious program of unifying the two standards. In 2001, this joint initiative resulted in a single specification called the Single UNIX Specification, Version 3 (SUSV3), that is also known as IEEE 1003.1:2001 (POSIX.1). In 2002, the International Organization for Standardization (ISO) approved SUSV3 and IEEE 1003.1:2001.

Some of the commercial UNIX based on system V are:

- IBM's AIX
- Hewlett-Packard's HPUX
- SCO's Open Server Release 5
- Silicon Graphics' IRIS
- DEC's Digital UNIX
- Sun Microsystems' Solaris 2

Some of the commercial UNIX based on BSD are:

- SunOS 4.1.X (now Solaris)
- DEC's Ultrix
- BSD/OS, 4.4BSD

Some Free UNIX are:

- Linux, written by Linus Torvalds at University of Helsinki in Finland.
- FreeBSD and NetBSD, a derivative of 4.4BSD

Conclusion

In this chapter we defined an operating system. We also looked at history of UNIX and features of UNIX that make it a popular operating system. We also discussed the convergence of different flavors of UNIX into Single Unix Specification (SUS) and Portable Operating System Interface for Computing Environments (POSIX).